

Remarks

By the foregoing Amendment, claims 1 and 10 are amended. Applicant respectfully submits that no new matter was added by the amendment and is fully supported by the specification at page 10, paragraph 31. Entry of the Amendment and favorable consideration thereof is earnestly requested.

The Examiner has rejected claims 1 - 18 under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,128,083 to Brooks et al. ("the '083 patent"), U.S. Patent No. 3,573,023 to Thomas et al. ("the '023 patent") or JP04108675 in view of U.S. Patent No. 5,228,245 to Rice et al. ("the '245 patent"). These rejections are respectfully traversed.

As amended, all the claims of the present invention require contacting a workpiece which does not comprise zirconia with a tool within a predetermined surface area, the tool comprising at least the same order of hardness as the workpiece and where the temperature of the workpiece is not elevated above room temperature.

The Examiner has stated that the '083 patent teaches contacting a workpiece with a tool where the temperature of the workpiece is not elevated above room temperature stating that the '083 patent only states that the process is "preferably . . . at sufficiently high temperature . . ." and that a reference must be considered for all of its teachings. Applicant agrees that the '083 patent must be analyzed in view of all of its teachings. The Examiner cites the language of claim 13 to establish that the process need not be performed at an elevated temperature (Col. 4, lines 44-58). However, Applicant respectfully submits that, prior to describing any preferred embodiments, the specification describes some general principles of the process stating that "[i]t has been found that the principle variables which have to be controlled during treatment of a hard engineering ceramics material in accordance with the process of the present invention to achieve the benefits ascribed above are as follows: ... 2. The temperature at which

the process is carried out must be less than that at which adhesion and seizure would occur between the surface of the hard engineering ceramics material being treated and the second material applying the point/line loading through processes of bulk diffusion yet high enough to enable significant dislocation mobility. This will usually be in the range of 0.3 Tm to 0.5 Tm." (Col. 2, lines 16-20 and 26-33.) While the Examiner has submitted that the '083 patent teaches that the use of an elevated temperature is only for certain preferred embodiments, a further reading of the specification points out that certain "principle variables . . . have to be controlled" and that while the temperature may vary, will usually be in a range of 420°C to 700°C. In addition, the '083 patent still teaches that the temperature of the workpiece must be "high enough to enable significant dislocation mobility" of which the bottom end is taught to be about 420°C. While the Examiner has submitted that claim 13 of the '083 patent does not list elevating the temperature as a claim element, applicant respectfully submits that the '083 patent teaches that the temperature of the workpiece has to be controlled to a temperature significantly higher than room temperature.

With respect to the '245 patent, applicant respectfully submits that the specification discloses "[t]ransformation toughening of ceramics is most well known in bodies containing metastable tetragonal zirconia particles." (Col. 1, lines 13-15.) The '245 patent further goes on to teach a method for hardening a ceramic comprising "partially stabilized zirconia (PSZ)" (Col. 1, lines 30-31), or "tetragonal zirconia ... referred to a 'TZP'" (Col. 1, lines 35 and 38-39), or "zirconia-toughened alumina (ZTA)." (Col. 1, lines 44-45.) Additionally, all of the examples listed in the specification of toughening a workpiece include use of zirconia (Col. 3, lines 39-46 and 62-64; Col. 4 lines 3-7 and 16-17). Applicant respectfully submits that the method taught in the '245 patent included zirconia in each case and will not work for ceramics at room temperature unless they contain zirconia.

Therefore, because neither the '083 patent nor the '245 patent teach, disclose or suggest contacting a workpiece which does not comprise zirconia with a tool within a

predetermined surface area, the tool comprising at least the same order of hardness as the workpiece and where the temperature of the workpiece is not elevated above room temperature as required by all the claims of the present invention, no combination of these two references can render the claims obvious.

Applicant further respectfully submits that the suggested combination of the '083 patent and the '245 patent may result in many differing inventions. For instance, with the suggested combination one could just as easily arrive at a method of contacting a workpiece that comprises PSZ, TZP or ZTA at an elevated temperature of between 0.3 Tm to 0.5 Tm. Alternatively, one could arrive at a method for contacting a workpiece that comprises PSZ, TZP or ZTA at room temperature. Therefore, applicant respectfully submits that one would need the benefit of the present application to choose the various elements from the cited references, as submitted by the Examiner, to arrive at the invention claimed in the present application, which therefore cannot be obvious.

The Examiner has further submitted that the claims of the present invention are obvious based upon the combination of the '023 patent with the '245 patent. Applicant respectfully disagrees with the Examiner that cemented carbides, cermets and other ceramic-type materials are true ceramics, such as aluminum oxide. In fact, the '023 patent teaches that cemented carbides are different from true ceramics variously categorizing them as "those comprising cemented carbides, e.g., tungsten carbide, or boron carbide" (cemented carbides/cermets/ceramic-type materials) and "those comprising aluminum oxides, or magnesium oxides" (ceramics) and "those comprising semi-conductor materials: silicon, germanium, etc." (Col. 1, lines 43-47.) In fact, the '023 patent groups "cemented carbides, and cermet, or ceramic-type materials" together, but does not include them with true ceramics. (Col. 3, lines 11-12) In commenting upon the difference between the groups the specification states that "[w]e have cited certain types, only for illustrative purposes; we suggest these – materials comprising tungsten carbide, boron carbide, aluminum oxide, or magnesium oxides – to encompass both the near ceramics and the true ceramics." (Col. 3, lines 51-55.) This

statement is supported by Col. 1, lines 43-44 where both tungsten carbide and boron carbide are included in the cemented carbide category or near ceramics, while aluminum oxide and magnesium oxide are listed as separate from the cemented carbides and are further described as true ceramics at Col. 3, lines 54-55. The '023 patent further goes on to teach that mechanical deformation of the near ceramics or cemented carbides may be carried out at normal room temperature (Col. 3, lines 61-63). In contrast, the '023 patent teaches that the true ceramics, such as aluminum oxide, require surface deformation in an elevated-temperature environment (Col. 3, lines 63-65). Applicant therefore respectfully submits that, while the '023 patent does teach the hardening of near ceramics or cemented carbides at room temperature, it does not teach the hardening of true ceramics at room temperature as required by all the claims of the present invention.

As previously stated, applicant respectfully submits that the '245 patent discloses a process of toughening workpieces comprising zirconia at room temperature; however, this process will not work for ceramics unless they contain zirconia.

Therefore, because neither the '023 patent nor the '245 patent teach, disclose or suggest contacting a workpiece which does not comprise a tool within a predetermined surface area, the tool comprising at least the same order of hardness as the workpiece and where the temperature of the workpiece is not elevated above room temperature as required by all the claims of the present invention, no combination of these two references can render the claims obvious.

Applicant further respectfully submits that the suggested combination of the '023 patent and the '245 patent may result in many differing inventions. For instance, with the suggested combination, one could just as easily arrive at a method of contacting a true ceramic workpiece that comprises PSZ, TZP or ZTA at an elevated temperature. Alternatively, one could arrive at a method of contacting a cemented carbide that comprises PSZ, TZP or ZTA at room temperature. Or, one could arrive at a method of

contacting a true ceramic workpiece that comprises PSZ, TZP or ZTA at room temperature. Therefore, applicant respectfully submits that one would need the benefit of the present application to choose the various elements from the cited references as submitted by the Examiner, to arrive at the invention claimed in the present application, which therefore cannot be obvious.

The Examiner has still further submitted that the claims of the present invention are obvious based upon the combination of JP04108675 with the '245 patent. Applicant has amended claims 1 and 10 to include the element that the tool comprise at least the same order of hardness as the workpiece. JP04108675 teaches and discloses that silicon nitride ceramic is subjected to wet honing treatment based on the use of glass beads. While the disclosure is silent upon the issue of the temperature of the workpiece during this process, applicant respectfully submits that this process will not achieve a desired goal of the present application, namely hardening the boundary layer strength of the surface of ceramic materials. The reason this process will not achieve the desired goal is that glass beads have a material strength and hardness which are well below the material strength and hardness of silicon nitride ceramic. As such, when the glass beads impact the surface of the ceramic, the beads will break rather than damaging the ceramic. This process, however, will not achieve the desired result of increasing the boundary layer strength of the surface of the ceramic material. Rather, as described in the specification of the present application, a "material having at least the same hardness as the workpiece to be treated is selected as tool material." (Page 10, par. 31.) Also taught in the specification is that "the brittle fracture limit on the tool geometry is determined." (Page 10, par. 31.) Therefore, applicant respectfully submits that, even if the method taught in JP04108675 is performed at room temperature, because it utilizes a tool with a significantly lower hardness than the workpiece, the boundary layer strength of the surface of the ceramic material will not be significantly affected.

Therefore, because neither JP04108675 nor the '245 patent teach, disclose or suggest contacting a workpiece which does not comprise zirconia with a tool within a predetermined surface area, the tool comprising at least the same order of hardness as the workpiece and where the temperature of the workpiece is not elevated above room temperature, as required by all the claims of the present invention, no combination of these two references can render the claims obvious.

Applicant further respectfully submits that the suggested combination of JP04108675 and the '245 patent may result in many differing inventions. For instance, the suggested combination may just as easily result in a method of contacting a ceramic workpiece that comprises PSZ, TZP or ZTA with glass beads. Alternatively, one could arrive at a method of irradiating a ceramic workpiece that comprises PSZ, TZP or ZTA at an elevated temperature or at a non-elevated temperature. Or, one could arrive at a method is simply barrel polishing a ceramic workpiece that comprises PSZ, TZP or ZTA at room temperature. Therefore, applicant respectfully submits that one would need the benefit of the present application to choose the various elements from the cited references as submitted by the Examiner, to arrive at the invention claimed in the present application, which therefore cannot be obvious. Even then, the suggested combination would have to be further modified to arrive at the claimed invention requiring that the tool be at least the same order of hardness as the workpiece.

In addition, with regard to the '245 patent, applicant respectfully submits that, as all the claims of the present invention specifically exclude the use of zirconia, it would not be obvious to disregard the core teachings of the '245 patent, namely the use of "tetragonal zirconia as the toughening constituent such as PSZ, TZP, and ZTA" and combine it with the cited prior art references to arrive at the present claims ('245 patent Col. 2, lines 26-27).

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It is respectfully submitted that claims 1 - 18 all of the claims remaining in the application, are in order for allowance, and early notice to that effect is respectfully requested.

Respectfully submitted,



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